that their very success emphasises the defectiveness of the present condition of things in regard to higher technical training. This condition is due to the difficulty of securing attendance at day courses in our many excellent institutions. There has been some improvement in this respect, but the number of students taking systematic higher courses is lamentably small. Sir Horace Plunkett is convinced that the tendency to bring the instruction in the evening technical institutes into the closest relationship with industrial requirements will go far to secure what is admittedly one of the most important desiderata to-day—the cooperation of employers and workers. It must be frankly recognised that the *raison d'être* of the evening technical school is industrial efficiency, that the apprenticeship system under modern industrial conditions must fail to educate the young worker effectively, and that the evening technical school must now undertake some of the teaching previously conferred in the workshop. The great usefulness of American technical institutions is due in a large measure to the individual interest taken in the students, not only during their attendance at the school, but during their subsequent career. The following papers were read and discussed:—The cooperation of adjacent authorities in the supply of higher technical education, by Principal A. F. Hogg, of West Ham, and monotechnic institutions, by Mr. Charles Harrap, of the St. Bride Foundation Institute, London.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 1, 1906.—"The Nitrification of Sewage." By Dr. G. **Reid.** Communicated by Prof. Gotch, F.R.S.

The author gives an account of certain observations he recently made which point to the conclusion that by using fine-grain filter particles the depth of percolating filters may be greatly reduced. A filter composed of $\frac{1}{8}$-inch medium, which had been in constant use for three years, was tapped at four depths in such a way that samples could be collected to show the degree of purification effected at 1-foot intervals downwards, and the conclusions arrived at are based upon the analysis of numerous samples collected during a period of about twelve months, the delivery to the filter being constant throughout and at a rate of 200 gallons per superficial yard. As regards the organic matter, both in suspension and solution in the septic tank effluent applied to the filter, the author found that the work of purification was effected at a depth of 1 foot from the surface, leaving very little work for the deeper layers to accomplish.

The following are the means of the more important figures of analyses:—

—	Parts per 100,000				
	Septic Tank	1 ft.	2 ft.	3 ft.	4 ft.
Solids in Suspension	7·60	0·25	0·09	0·14	0·00
Free Ammonia ...	1·716	0·036	0·020	0·009	0·043
Albuminoid Ammonia	0·340	0·052	0·037	0·031	0·027
Oxygen absorbed in 4 hours at 80°F. ...	2·184	0·328	0·286	0·244	0·259
Nitrous Nitrogen ...	0·000	0·003	0·007	0·008	0·002
Nitric Nitrogen ...	0·00	2·07	1·99	1·85	1·99

As regards the carbonaceous matter, the oxidation appeared to be equally rapid, for not only did the reduction in oxygen absorbed reach practically its maximum at 1 foot depth, but the air collected from the filter at different depths gave the following amounts of CO_2 per 1000:—1 foot, 19·5; 2 feet, 21·5; 3 feet, 20·0; 4 feet, 20·0. As regards the suspended organic solids, they are practically all retained within the first foot, where liquefaction is effected (it is suggested by aërobic organisms). In confirmation of this, the following mean figures of percentage loss on ignition of filter particles taken from different depths are given:—6 inches, 3·25; 1 foot, 0·99; 2 feet 0·65; 3 feet, 0·53; 4 feet, 0·53.

As regards the remarkable increase in the free ammonia in the samples from the lowest tray, it is suggested that the circumstance may be accounted for by a revival of anaërobic changes, the result of the asphyxiating effect of the products of combustion produced above.

Anthropological Institute, January 22.—Annual General meeting.—Prof. W. Gowland, president, in the chair.—Address on the dolmens and burial mounds of the early emperors of Japan: the **President.** It is extremely probable that the Japanese obtained the idea of raising mounds from the Chinese, the earliest burial mound in China dating from 1848 B.C. Little is known about the earliest Japanese mounds, but the later ones are always more or less large, and invariably contain either a sarcophagus or dolmen. There is an extremely large number of these mounds in Japan, and Prof. Gowland himself examined 406. It is of interest to note that the dolmens are always near the coast or in the basins of the larger rivers, which points to the fact that at the time of their erection the Japanese only occupied these districts, the other parts of the country being inhabited by the primitive aborigines—the Ainu. The distribution of the early Imperial mounds is also of importance historically. They are found in four districts, which goes to prove that at an early date the country had no central Government, but that there were at least four independent tribes, each occupying one of the districts where the large Imperial mounds are found. The date of these mounds is between the second century B.C. and the fifth or sixth of our era. As to the mounds themselves, the Imperial ones are double, with a conical peak at one end. They are all of very great size, and are terraced and moated. In plan they are seen to be a combination of the square and circular varieties, but whether this has any significance is not known. One interesting feature is that round each terrace a series of terra-cotta tubes—"Haniwa"—about 18 inches high and 15 inches broad, are set in rows. They may have been placed there for structural reasons, or they may represent the wives, attendants, &c., who formerly were buried with the emperor. This practice was discontinued in 2 B.C., and by an Imperial decree terra-cotta figures were substituted for the human victims. Many of these figures have been found, and in some cases they terminate in a "Haniwa." The largest of the Imperial mounds are in the central provinces; the largest of all is 2000 feet long, and covers approximately an area of eighty-four acres. The interment is always in the conical peak of the circular part of the mounds. They are, as a rule, entirely artificial, but occasionally a natural eminence has been turned to account.

Physical Society, January 25.—Prof. J. Perry, F.R.S., president, in the chair.—The strength and behaviour of brittle materials under combined stress: W. A. **Scoble.** The results described in the paper are a continuation of a series obtained from tests on a ductile material. The bars were of cast iron, $\frac{3}{4}$-inch diameter, 30 inches between the bending supports, subjected to bending and twisting to fracture. The maximum principal stress and the maximum shear, calculated on the assumption that there was no yield, each varied about 40 per cent. Plotting the corresponding bending and twisting moments, the points lie on an ellipse, the twisting moment being about 3000 lb. inches, and the bending moment 2200 lb. inches at fracture. In all cases, except that of simple bending, the fracture was a spiral, completed by a part making a small angle with the axis and invariably coming under the knife-edge.—Recent improvements in spectrophotometers: F. **Twyman.** The paper deals with a form of Hüfner spectrophotometer designed in 1904, and consists of two parts:—(A) The evaluation of the errors due to the polarisation produced by the dispersion-prism and by the Hüfner rhomb which brings about the accurate juxtaposition of the two beams of light the intensities of which are to be compared; and the method by which in the recently constructed instruments it is arranged for these effects to neutralise one another. (B) The use of the instrument as a spectropolarimeter by placing in the space between the dispersion-prism and the second Nicol the media the optical rotations of which it is required to measure.

Challenger Society, January 30.—Mr. E. W. L. Holt in the chair.—Fishes captured by the Marine Biological Association's fishery steamer *Huxley* in November, 1906, at the channel entrance from the Bay of Biscay: L. W. **Byrne.** The collection was chiefly interesting as providing records of species already known from deeper water, *e.g. Synaphobranchus pinnatus*, and *Scopelus glacialis*, *S. punctatus*, and *S. crocodilus*. Attention was also directed to specimens of the little-known *Onos biscayensis* and the recently described *Pteridium alleni*.—The Decapoda collected by H.M.S. *Research* in the Bay of Biscay, 1900: S. W. **Kemp.** The chief interest of this collection was in a fine series of *Acanthephyra purpurea*, which ranged from the length of 4·3 mm. up to an adult of 81 mm. Unlike *A. debilis*, in which Contière has shown that the larva is hatched with peræopods, uropods, and pleopods fully formed, this closely allied species leaves the egg as a Zoœa. The series of larvæ was fully described and figured, and shows a remarkable reduction at a certain stage of the cornea and rostrum, followed by their subsequent growth. Other interesting captures were *Sergestes arcticus*, *Gennadas parvus*, and *Acanthephyra debilis*. The author also described and figured an unknown larva allied to Caricyphus of Spence Bate.

Society of Chemical Industry (London Section), February 4.—Mr. R. J. Friswell in the chair.—Chemical composition of some motor-tyre rubbers: Dr. P. **Schidrowitz** and F. **Kaye.** The authors conclude (1) that in many cases tyre trouble is directly referable to chemical defects (such as over or under curing, unsuitability of the quality of the rubber, excess of mineral matter, &c.) of the rubber mixings; (2) that manufacturers are by no means agreed as to nature and quantity of the various ingredients and conditions of manufacture to be employed; (3) that it is apparent from the widely divergent results obtained in some cases with tyres of the same size and make that the process of manufacture is not always conducted on sound scientific lines, but, on the other hand, they point out that some of the results of their investigations indicate that even and constant quality may be obtained by adequate supervision of manufacture.—Composition of some new crude rubbers: Dr. P. **Schidrowitz** and F. **Kaye.** The authors give the results of examination of rubbers from the newer sources of supply, such as Ceylon, Uganda and Malaya, and also of a sample of *Castilloa elastica* from Mexico. The results of experiments on a series of Ceylon biscuit rubbers distinctly support the view that it is a mistake to turn out rubber in thin biscuit form, and the authors make some observations on the apparent nature of the changes produced in rubbers prepared in this manner. They also describe a modification of the Ditmar method of analysis of crude rubbers which they have devised, and give some preliminary figures referring to the nature of the proteids, resins, and mineral matters in some of the rubbers examined.—Sources of carbon dioxide in the determination of nitrogen in organic compounds by the absolute method: C. **Young** and B. **Caulwell.** The authors described a modification of Theile's apparatus (*Annalen*, 1889, 253, 242) for the evolution of carbonic acid in an external generator. The design of the mercury trap and safety tube are novel. The carbon dioxide produced is claimed not to contain 0·1 c.c. of air per 5 litres.

PARIS.

Academy of Sciences, February 4.—M. A. Chauveau in the chair.—The secretary announced to the academy the death of Prof. Mendeléeff.—Researches on the solar atmosphere. Vapours with dark lines and clusters of particles: H. **Deslandres** and L. **d'Azambuja.** A detailed account of the work done at the Observatory of Meudon during 1906 with various forms of apparatus.—Autopsy of the African elephant "Sahib," which died on January 29 at the Museum: Edmond **Perrier.**—Determinism of the superiority of the energy expenditure due to the assimilation of albumenoid foods: A. **Chauveau.** The author's experiments are described in detail. Of the numerous conclusions drawn from these results, the most important is that it is necessary to give up the use of the heat of combustion as a guide in the theory of food.—A new contribution to the study of trypanosomiasis of the Upper Niger: A. **Laveran.** A study of a new species closely allied to *Trypanosoma dimorphon*, arising from the blood of an infected sheep. A close comparison of *T. dimorphon* with the new organism shows that the two are not identical, and the name *T. pecaudi* is proposed for the new species.—The relation between falls of barometric pressure and the evolution of fire-damp in mines: G. **Bigourdan.** A comparison of the times of the colliery explosions in the Lens and Saarbruck basins on January 28 with the heights of the barometer shows that here, as in other cases, the explosions occurred at the time of a rapid fall of the barometer following a long period during which the readings of the barometer had been high.—Prince Roland Bonaparte was elected a member in the place of the late Raphael Bischoffsheim.—Some new variable stars with very rapid variations in light intensity: Jules **Baillaud.** In the photography of the chart of the sky the negative receives small successive displacements at intervals of thirty minutes, so that each star is represented by three contiguous images. These images will be similar if the condition of the sky has not changed, different if it has varied, but in the latter case all the images will be affected similarly. In some of the photographs obtained at Paris during 1906 several of these triple images vary considerably in the intensity of the images, and two at least of these cases appear to be due to very rapid variations in the brightness of the star. In one instance the three images are respectively of magnitudes 14·5, 13, and 12·7. Of the forty plates examined this year by MM. A. Boinot and J. Baillaud, containing more than 50,000 stars, only three other stars have been found exhibiting this peculiarity, and two of these are due to a grain of dust on the plate.—The quadrature of curved surfaces: Zoard **de Geöcze.**—The comparative study of helices and aëroplanes: P. **Tsoucalas** and J. **Vlahavas.**—The refraction of compound gases: Jules **Amar.** The author examines the proposition that the refraction of a compound gas is the sum of the refractions of the atoms which enter into the molecule, and shows that this proposition holds within the range of experimental error.—The resonance phenomena in the case of transformers with open magnetic circuit, and their utility in the production of strong electric sparks: G. A. **Hemsalech** and C. **Tissot.** Resonance effects are generally avoided in alternating-current circuits on account of the harmful results on the insulation; but there are certain cases in which there is a considerable advantage in establishing resonance, and one of these is the production of powerful electric sparks. An account is given of the construction of a coil in which this resonance effect is utilised. A transformer of the type described is useful, not only in spectroscopy, but also in wireless telegraphy.—Experimental researches on dielectric solids: Louis **Malclès.**—An attempt at a theory of phosphorescence and fluorescence: J. **de Kowalski.** A development of some views of Prof. J. J. Thomson on the production of light under the influence of electric discharges. The theory is in general agreement, both qualitatively and quantitatively, with experiment.—The molecular weights of various gases calculated by the method of critical densities: Daniel **Berthelot.** Regarding the correction for the compressibility of a gas, the author points out that it is not a matter of indifference which formula is used for the variation of pv. This expression has been taken as a linear function of the density or of the pressure; the former is correct. The atomic weight of chlorine, deduced from the density of hydrochloric acid, falls between 35·454 and 35·478; that of sulphur, from sulphur dioxide, between 32·050 and 32·064.—The ethyl ether oxide of $\alpha\alpha$-dichloro*iso*propyl alcohol and on dibromoacetic aldehyde: P. **Freundler.** A preliminary notice indicating the line of work on which the author is engaged.—Some reactions of sodium amide: Louis **Meunier** and E. **Desparmet.** Sodium amide reacts with ethylene bromide, the products being acetylene, ammonia, and sodium bromide. With chloroform, the reaction starts with difficulty, but once started becomes explosive, ammonia, together with a mixture of sodium chloride and cyanide, resulting. The application of sodium amide to the preparation of diphenylbenzylamine, sodium diazo-

amidobenzene, and the sodium derivative of ethyl malonate is described.—The composition of the plant juices extracted from stems and leaves: G. **André.**—The chemical composition of the Koch bacillus and its binding material. Relation with resistance to acids: Jules **Auclair** and Louis **Paris.** The fatty matters were extracted by successive treatments with alcohol, ether, and chloroform, petroleum ether alone being incapable of extracting the whole of these substances. These fatty matters, the protoplasm, and cellulose all give the Ehrlich reaction.—Autopsy of the African elephant "Sahib," which died at the Museum on January 29: Mme. Marie **Phisalix.** The death resulted from an accidental chill, leading to inflammation of the lungs, there being no sign of any chronic disease.—A new view of the Blastodinideæ (*Apodinium mycetoides*): Edouard **Chatton.**—The chain of the Puys and the lesser Puys: Ph. **Glangeaud.**—Note on the Palæozoic strata of the eastern edge of the Central Plateau: Albert **Michel-Lévy.**—The direction of the earlier folds in the central and eastern Pyrenees: Léon **Bertrand.**—The age of the Eocene deposits of the Armorican massif and of the Ronca zone: Jean **Boussac.**

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part v. for 1906, contains the following memoirs communicated to the society:—

July 28.—Questions of crystal-physics, ii., the action of a magnetic field on the optical behaviour of pleochroitic crystals: W. **Voigt.**

October 27.—Real and apparent "transgredient stratification": A. **von Koenen.**—Measurements of the ionisation and radio-activity of the air over the open sea (Atlantic and Pacific): F. **Linke.**—Meteorological kite observations in Samoa: F. **Linke.**—Eulerian integrals: J. **Thomae.**

December 8.—The behaviour of sulphides of the heavy metals in aqueous solution: Oskar **Weigel.**

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 14.

ROYAL SOCIETY, at 4.30.—On the Purification and Testing of Selenion: R. Threlfall, F.R.S.—On the Specific Inductive Capacity of a Sample of Highly Purified Selenium: O. U. Vonwiller and W. H. Mason.—Investigation of the Law of Burning of Modified Cordite: Major J. H. Mansell, R.A.—The Thermomagnetic Analysis of Meteoric and Artificial Nickel-Iron Alloys: S. W. J. Smith.

ROYAL INSTITUTION, at 3.—The Minute Structures of Igneous Rocks and their Significance: Alfred Harker, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Practical Side of Famine in India: Sir Frederick S. P. Lely, K.C.I.E.

LONDON INSTITUTION, at 6.—Scientific Method: Prof. H. E. Armstrong, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—Groups defined by the Order of the Generators and the Order of their Commutator: Prof. G. A. Miller.—On the Reduction of the Factorisation of Binary Septans and Octans to the Solution of a Pellian: Dr. T. Stuart.—On Repeated Integrals: Dr. E. W. Hobson.—The Construction of the Line drawn through a Given Point to meet Two Given Lines: Prof. W. Burnside.

FRIDAY, FEBRUARY 15.

ROYAL INSTITUTION, at 9.—Foraminifera: J. J. Lister, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Annual General Meeting.

SATURDAY, FEBRUARY 16.

ROYAL INSTITUTION, at 3.—Röntgen, Kathode, and Positive Rays: Prof. J. J. Thomson, F.R.S.

MONDAY, FEBRUARY 18.

VICTORIA INSTITUTE, at 4.30.—The Spread of the European Fauna: Prof. J. Logan Lobley.

TUESDAY, FEBRUARY 19.

ROYAL INSTITUTION, at 3.—The Visual Apparatus of Man and Animals: Prof. William Stirling.

ROYAL STATISTICAL SOCIETY, at 5.

ZOOLOGICAL SOCIETY, at 8.30.

FARADAY SOCIETY, at 8.—The Present Position and Future Prospects of the Electrolytic Alkali and Bleach Industry: J. B. C. Kershaw.

INSTITUTION OF CIVIL ENGINEERS, at 8.—(*Continued discussion*) Modern Motor-vehicles: Col. R. E. B. Crompton, C.B.

WEDNESDAY, FEBRUARY 20.

SOCIETY OF ARTS, at 8.—Cold Storage and Food Supply: Hal Williams.

ROYAL MICROSCOPICAL SOCIETY, at 8.—An Early Criticism of the Abbe Theory: J. W. Gordon.—Some Tardigrada of the Sikkim Himalaya: James Murray.—On Some Rhizopods from the Sikkim Himalaya: Dr. Eugène Penard.—*Exhibition*: Slides of Marine Zoological Objects lent by Mr. Flatters.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Report on the Phenological Observations for 1906: E. Mawley.—The Metric System in Meteorology: R. Inwards.

THURSDAY, FEBRUARY 21.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Estimation of Chloroform in the Blood of Anæsthetised Animals: G. A. Buckmaster and J. A. Gardner.—On Electrical Seed-Testing: Prof. T. Johnson.—On Longitudinal Symmetry in Phanerogamia: Prof. Percy Groom.—And other Papers.

ROYAL INSTITUTION, at 3.—The Minute Structure of Igneous Rocks and their Significance: Alfred Harker, F.R.S.

CHEMICAL SOCIETY, at 8.30.—The Constitution of Oxyazo-compounds: W. B. Tuck.—The Influence of Solvents on the Rotation of Optically Active Compounds, Part ix., A New General Method for Studying Intramolecular Change: T. S. Patterson and A. McMillan.—The Reduction Products of ortho- and para-Dimethoxybenzoin: J. C. Irvine and A. M. Moodie.—Replacement of Halogens by Hydroxyl, i., The Hydrolytic Decomposition of Hydrogen and Sodium Monochloroacetates by Water and by Alkali, and the Influence of Neutral Salts on the Reaction Velocities: G. Senter.—The Reaction of Ammonium Salts with the Constituents of the Soil: A. D. Hall and C. T. Gimingham.

LINNEAN SOCIETY, at 8.—The Percy Sladen Trust Expedition to the Indian Ocean, Introduction, Part i., Ceylon to Mauritius: J. Stanley Gardiner.—Land Nemerteans, with a Note on the Distribution of the Group: R. C. Punnett.—Land Crustaceans: L. A. Borradaile.—Hymenoptera: P. Cameron.—Dragon Flies: F. F. Laidlaw.—Fourmis des Seychelles, Admirantes, Farquhar et Chagos: Prof. A. Forel.—Pycnogonidæ: G. H. Carpenter.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Lecture on "Modern Theory of Conduction of Electricity in Metals": Prof. J. J. Thomson, F.R.S.

FRIDAY, FEBRUARY 22.

ROYAL INSTITUTION, at 9.—Flame in Gas and Petrol Motors: Dugald Clerk.

PHYSICAL SOCIETY, at 5.—Transformer Indicator Diagrams: Prof. Lyle.—Ionisation of Gases by α Particles of Radium: Prof. Bragg.—A Micro-manometer: B. Roberts.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Impurities in Boiler Feed-water; their Nature, Effect and Elimination: F. E. Walker.

SATURDAY, FEBRUARY 23.

ROYAL INSTITUTION, at 3.—Röntgen, Kathode, and Positive Rays: Prof. J. J. Thomson, F.R.S.

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